

What is claimed is:

1. A mirror angle control apparatus for a power mirror system that includes a mirror, the mirror angle control apparatus comprising:

a single electric motor; and

first and second reciprocable members that are arranged between the motor and the mirror and are selectively reciprocated by rotational force conducted from the motor to tilt the mirror, wherein:

when the motor is rotated in a first rotational direction, the second reciprocable member is held stationary, and the first reciprocable member is reciprocated to tilt the mirror in a vertical direction; and

when the motor is rotated in a second rotational direction, which is opposite from the first rotational direction of the motor, the first reciprocable member is held stationary, and the second reciprocable member is reciprocated to tilt the mirror in a horizontal direction.

2. The mirror angle control apparatus according to claim 1, wherein:

the first reciprocable member is connected to the mirror through a first universal joint assembly; and

the second reciprocable member is connected to the mirror through a second universal joint assembly.

3. The mirror angle control apparatus according to claim 1, wherein:

a central axis of the first reciprocable member and a central axis of the second reciprocable member are generally parallel to one another;

the central axis of the first reciprocable member intersects a vertical imaginary line, which extends vertically through a center of the mirror, at a location spaced away from the center of the mirror; and

the central axis of the second reciprocable member intersects a horizontal imaginary line, which extends horizontally through the center of the mirror, at a location spaced away from the center of the mirror.

4. The mirror angle control apparatus according to claim 3, wherein each of the central axis of the first reciprocable member and the central axis of the second reciprocable member is generally perpendicular to a corresponding imaginary line that is parallel to a rotational axis of the motor.

5. The mirror angle control apparatus according to claim 1, further comprising:

first and second rotatable members that are rotatable relative to and are slidably engaged with the first and second reciprocable members, respectively; and

a switchable type transmission mechanism that is arranged between the motor and the first and second rotatable members,

wherein:

one of the first reciprocable member and the first rotatable member has a first endless helical groove, which includes two helical groove sections that extend in opposite helical directions, respectively, and are connected one another to form an endless path, and the other one of the first reciprocable member and the first rotatable member has a first slide piece, which is slidably received in the first endless helical groove;

one of the second reciprocable member and the second rotatable member has a second endless helical groove, which includes two helical groove sections that extend in opposite helical directions, respectively, and are connected one another to form an endless path, and the other one of the second reciprocable member and the second rotatable member has a second slide piece, which is slidably received in the second endless helical groove;

when the motor is rotated in the first rotational direction, the switchable type transmission mechanism transmits rotational force of the motor to the first reciprocable member through the first rotatable member and prevents transmission of the rotational force of the motor to the second reciprocable member through the second rotatable member; and

when the motor is rotated in the second rotational direction, the switchable type transmission mechanism transmits rotational force of the motor to the second reciprocable member through the second rotatable member and prevents transmission of

the rotational force of the motor to the first reciprocable member through the first rotatable member.

6. The mirror angle control apparatus according to claim 5, wherein:

each of the first and second rotatable members is formed into a cylindrical body that has a cylindrical blind hole, which is opened in one end of the rotatable member;

each of the first and second reciprocable members is formed into a cylindrical body that has an outer diameter smaller than an inner diameter of the cylindrical blind hole of the corresponding rotatable member and is reciprocably received in the cylindrical blind hole of the corresponding rotatable member;

the first endless helical groove is formed in one of an inner peripheral surface of the first rotatable member and an outer peripheral surface of the first reciprocable member;

the first slide piece is rotatably arranged in the other one of the inner peripheral surface of the first rotatable member and the outer peripheral surface of the first reciprocable member, wherein a rotational axis of the first slide piece extends in a direction generally perpendicular to a reciprocating direction of the first reciprocable member;

the second endless helical groove is formed in one of an inner peripheral surface of the second rotatable member and an outer peripheral surface of the second reciprocable member; and

the second slide piece is rotatably arranged in the other one of the inner peripheral surface of the second rotatable member

and the outer peripheral surface of the second reciprocable member, wherein a rotational axis of the second slide piece extends in a direction generally perpendicular to a reciprocating direction of the second reciprocable member.

7. The mirror angle control apparatus according to claim 5, wherein the switchable type transmission mechanism includes:

a worm gear that is connected to the motor and is rotated by the rotational force of the motor;

a first one-way clutch mechanism that is placed between the worm gear and the first rotatable member, wherein the first one-way clutch mechanism conducts the rotational force from the worm gear to the first rotatable member and to the first reciprocable member upon rotation of the motor in the first rotational direction and prevents conduction of the rotational force from the worm gear to the first rotatable member and to the first reciprocable member upon rotation of the motor in the second rotational direction; and

a second one-way clutch mechanism that is placed between the worm gear and the second rotatable member, wherein the second one-way clutch mechanism conducts the rotational force from the worm gear to the second rotatable member and to the second reciprocable member upon rotation of the motor in the second rotational direction and prevents conduction of the rotational force from the worm gear to the second rotatable member and to the second reciprocable member upon rotation of the motor in the first rotational direction.

8. The mirror angle control apparatus according to claim 7, wherein the switchable type transmission mechanism further includes:

a first speed reducing gear arrangement that is arranged on a first side of the worm gear, wherein the first speed reducing gear arrangement is meshed with the worm gear and is connected to the first one-way clutch mechanism to reduce a rotational speed transmitted from the worm gear to the first one-way clutch mechanism in comparison to a rotational speed of the worm gear; and

a second speed reducing gear arrangement that is arranged on a second side of the worm gear, which is opposite from the first side of the worm gear, wherein the second speed reducing gear arrangement is meshed with the worm gear and is connected to the second one-way clutch mechanism to reduce a rotational speed transmitted from the worm gear to the second one-way clutch mechanism in comparison to the rotational speed of the worm gear.

9. The mirror angle control apparatus according to claim 8, wherein:

the first speed reducing gear arrangement includes:

a first primary gear that is meshed with the worm gear;

a first intermediate gear that is coaxially secured to the center of the first primary gear; and

a first secondary gear that is meshed with the first

intermediate gear and has a recess in a center of the first secondary gear;

the first one-way clutch mechanism includes:

a first clutch plate that is received in the recess of the first secondary gear and is secured to the first rotatable member to rotate integrally with the first rotatable member, wherein the first clutch plate includes at least one driven-side engaging portion; and

at least one driving-side engaging portion securely provided in an inner peripheral wall of the recess of the first secondary gear, wherein:

when the motor is rotated in the first rotational direction, the rotational force of the motor is transmitted to the first secondary gear through the worm gear, the first primary gear and the first intermediate gear to rotate the first secondary gear in a first rotational direction, so that the at least one driving-side engaging portion of the first secondary gear is engaged with the at least one driven-side engaging portion of the first clutch plate to rotate the first clutch plate and the first rotatable member and thereby to reciprocate the first reciprocable member; and

when the motor is rotated in the second rotational direction, the rotational force of the motor is transmitted to the first secondary gear through the worm gear, the first primary gear and the first intermediate gear to rotate the first secondary gear in a second rotational direction, which is opposite from the first rotational direction of the first secondary gear, so that

the at least one driving-side engaging portion of the first secondary gear is disengaged from the at least one driven-side engaging portion of the first clutch plate, and the first secondary gear is rotated relative to the first clutch plate without rotating the first clutch plate;

the second speed reducing gear arrangement includes:

a second primary gear that is meshed with the worm gear;

a second intermediate gear that is coaxially secured to the center of the second primary gear; and

a second secondary gear that is meshed with the second intermediate gear and has a recess in a center of the second secondary gear;

the second one-way clutch mechanism includes:

a second clutch plate that is received in the recess of the second secondary gear and is secured to the second rotatable member to rotate integrally with the second rotatable member, wherein the second clutch plate includes at least one driven-side engaging portion; and

at least one driving-side engaging portion securely provided in an inner peripheral wall of the recess of the second secondary gear, wherein:

when the motor is rotated in the second rotational direction, the rotational force of the motor is transmitted to the second secondary gear through the worm gear, the second primary gear and the second intermediate gear to rotate the second secondary gear in a first rotational direction, so that the at



least one driving-side engaging portion of the second secondary gear is engaged with the at least one driven-side engaging portion of the second clutch plate to rotate the second clutch plate and the second rotatable member and thereby to reciprocate the second reciprocable member; and

when the motor is rotated in the first rotational direction, the rotational force of the motor is transmitted to the second secondary gear through the worm gear, the second primary gear and the second intermediate gear to rotate the second secondary gear in a second rotational direction, which is opposite from the first rotational direction of the second secondary gear, so that the at least one driving-side engaging portion of the second secondary gear is disengaged from the at least one driven-side engaging portion of the second clutch plate, and the second secondary gear is rotated relative to the second clutch plate without rotating the second clutch plate.

10. A power mirror system comprising:

a mirror;

a single electric motor; and

first and second reciprocable members that are arranged between the motor and the mirror and are selectively reciprocated by rotational force conducted from the motor to tilt the mirror, wherein:

when the motor is rotated in a first rotational direction, the second reciprocable member is held stationary, and the first reciprocable member is reciprocated to tilt the mirror in a

vertical direction; and

when the motor is rotated in a second rotational direction, which is opposite from the first rotational direction of the motor, the first reciprocable member is held stationary, and the second reciprocable member is reciprocated to tilt the mirror in a horizontal direction.